

and the specific subject matter of claim 12 now appears as new claims 24 and 25.

Reconsideration is accordingly respectfully requested, for the rejection of certain of the claims as unpatentable over TANGHE et al. in view of HIATT et al., TUNC and ARAKI.

There is attached a complete copy of the article by TANGHE et al., as well as a second article of TANGHE et al. which directly follows the one cited in the Official Action. This will help explain the essential differences between the claimed subject matter and the process disclosed by TANGHE et al.

Those differences are as follows:

a) TANGHE et al. discloses a conventional prior art method for acetylation of cellulose which was acknowledged by the applicants themselves (see page 1, lines 16-28 of the present specification).

As is pointed out in the Official Action on page 6, line 6, the final product obtained by TANGHE et al. in the cited reference consists of a cellulose triacetate, because the experimental conditions used by TANGHE et al. necessarily cause the acetylation reaction to achieve completion, as will be discussed hereafter. This is the reason why, for obtaining final products with various acetylation degrees, TANGHE et al. must perform a further step of hydrolysis of the thus-obtained cellulose triacetate, as is disclosed in the attached article of TANGHE et al. (pages 198-201). Again, these prior art references

disclosing the production of a cellulose triacetate and then the hydrolysis of this triacetate product in order to obtain the desired acetylation degree already recited on page 1, lines 16-28 of the specification.

b) The direct production of a cellulose triacetate product by TANGHE et al. is explained by the fact that these authors perform acetylation of cellulose using acetic anhydride in a molar excess.

More specifically, TANGHE et al. use 10 grams of cotton linters (see page 194, line 1 of the first paragraph) and 50 ml of acetic anhydride (see page 194, lines 3-4, second paragraph).

(i) The molecular weight of acetic anhydride is about 102 and its density is 1.08 (see the herewith enclosed excerpt from the Merck Index, twelfth edition). Thus, a volume of 50 ml of acetic anhydride used by TANGHE et al. corresponds to about 0.53 moles.

(ii) Cellulose consists exclusively of a polymer of anhydroglucose moieties, the molecular weight of which is about 180 (see the herewith enclosed excerpt from the Merck Index, twelfth edition). The polymerization of the glucose moieties, within the cellulose chains, leads to the loss of one molecule of water, leading to a polymeric chain of anhydroglucose units having each a molecular weight of about 162. Thus, 10 g of cellulose, as used by TANGHE et al. consist of about 0.062 moles of anhydroglucose units.

(iii) Thus, when using 0.53 moles of acetic anhydride and 0.062 mole of anhydroglucose, TANGHE et al. performed the acetylation reaction with about 8.52 moles of acetic anhydride per mole of anhydroglucose, which is a large excess of acetic anhydride, which explains why only cellulose triacetate molecules are obtained at the end of the process.

c) This is also the reason why a further step of hydrolysis of the first step final product cellulose triacetate is compulsory to obtain final products possessing various acetylation degrees, as disclosed by TANGHE et al. (pages 198-201).

d) In contrast to TANGHE et al., the presently claimed method allows the direct production of cellulose sulfoacetate products with the desired acetylation degree, without the need of any further step of hydrolysis. This result is achieved according to the invention by using non-excess amounts of acetic anhydride, more specifically by using acetic anhydride in amounts ranging from 3 to 7 moles per mole of anhydroglucose. This is disclosed notably on page 2, lines 6-10 of the present specification.

e) Because TANGHE et al. relate exclusively to a two-step method, one skilled in the art would have found no indication in TANGHE et al. suggesting any technical advantage which would be result from a direct production of cellulose sulfoacetate of the desired acetylation degree. Indeed, one

skilled in the art would have found no indication in TANGHE et al. as to what possible technical means should be used for performing a one-step method allowing the direct production of cellulose sulfoacetate having the desired acetylation degrees.

As to HIATT et al.:

a) HIATT et al. disclose a method for preparing cellulose sulfoacetate, wherein the acetylation reaction is performed under non-acid conditions (see column 1, lines 11, 20-23, 24-27 and the claims), in contrast to the previously known methods which employ acetic-type catalysts (see column 1, lines 12-13), and as is also the case for the presently claimed method.

b) More specifically, the non-acid conditions used by HIATT et al. are achieved by using an alkali metal salt of acyl sulphuric acid (see column 1, lines 30-35 and the examples).

As disclosed in the examples, the reaction medium consists of a mixture of acetic anhydride, sodium acetate, acetic acid and sulphuric acid, which is completely distinct from the acidic conditions used according to the claimed method wherein, notably, no sodium acetate is used.

c) Because the method disclosed by HIATT et al., which makes use of non-acid conditions, is completely distinct from the method disclosed by TANGHE et al., which makes use of acidic conditions, these two prior art documents would have not been combined by one skilled in the art.

Further, even if the one skilled in the art were nevertheless to have considered the disclosure of HIATT et al., he or she would not have overcome the lack of teachings of TANGHE et al. as regards the amount of acetic anhydride to be used for the direct production of cellulose sulfoacetate of the desired acetylation degree.

As to TUNC:

TUNC discloses a method for preparing cellulose sulfoacetate according to a two-step method, namely:

a) a step for sulfating cellulose using a sulfating mixture comprising acetic anhydride, alkali sulphate, glacial acetic acid and sulphuric acid; and

b) a step for acylating the sulfated cellulose obtained in step a) using an acetylating agent such as acetic anhydride (see column 3, lines 9-18) of TUNC.

Thus, the two-step method disclosed by TUNC is completely distinct from the one-step method which is presently claimed, wherein the sulphating and acylating reactions are performed simultaneously.

Indeed, one skilled in the art would have found no indication in TUNC that would have allowed overcoming the lack of teachings of TANGHE et al. and HIATT et al.

In fact, TUNC discloses a method which is distinct both from the one disclosed by TANGHE et al. and the one disclosed by HIATT et al. It follows that one skilled in the art would have

not objectively combined these three documents, the respective teachings being very far one from each other.

As to ARAKI:

a) ARAKI discloses a method for obtaining cellulose sulfoacetate wherein the desired degree of acetylation can be obtained by controlling the temperature of the acetylation reaction.

b) Again, like TANGHE et al., ARAKI makes use of an acetylation step using acetic anhydride in a large molar excess, even a higher excess than that used by TANGHE et al.

ARAKI uses the same acetic anhydride/cellulose ratio in all the assays, namely 10g purified cotton fibers and 120g acetic anhydride. Thus, ARAKAI uses about 0.062 moles anhydroglucose and 1.17 moles (120/102) acetic anhydride (see the above comments on TANGHE et al. for a more detailed calculation).

Consequently, in the method disclosed by ARAKI, about 19 moles acetic anhydride per mole anhydroglucose are used in the acetylation step, which is an even larger molar excess than that used by TANGHE et al.

c) Indeed, the teachings of ARAKI would have dissuaded one skilled in the art from using the reaction conditions of the presently claimed method, particularly as regards the molar ratio between acetic anhydride and anhydroglucose.

As the claims bring out these distinctions with ample particularity, it is believed that they are all patentable, and reconsideration and allowance are respectfully requested.

Attached hereto is a marked-up version of the changes made to the specification and claims. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Paragraph beginning at page 1, line 16, has been amended as follows:

In most techniques according to the prior art, obtaining hydrosoluble cellulose acetate, usually having an acetylation degree within the range from 0.5 to 1, goes through the formation of a cellulose triacetate followed by [an acetolyse deacetylation] hydrolysis of the acetyl groups, for example, according to Tanghe L.J. et al. (1963) : "Cellulose acetate" in Methods in Carbohydrate Chemistry. Vol. 3, Whistler R.L. (ed.) 193-212, Academic Press, New York or according to Samios E. et al. (1997): "Preparation, characterization and biodegradation studies on cellulose acetates with varying degrees of substitution", Polym., 38 (12) : 3045-3054. Said deacetylation may further be performed by methanolysis, for example, according to Buchanan C.M., (1991): "Preparation and characterization of cellulose monoacetates : the relationship between structure and water solubility", Macromol., 24 : 3060-3064.

Paragraph beginning at page 6, line 1, has been amended as follows:

Example 1 : [Obtention] Preparation of cellulose sulfoacetates

IN THE CLAIMS:

Claim 1 has been amended as follows:

1. (amended) Process for directly producing a blend of [hydrosoluble] water soluble cellulose sulfoacetate derivatives through esterification of a cellulose material, comprising the steps of:

(i) suspending the cellulose material in a solution containing glacial acetic acid [solution] and eliminating the excess acetic acid,

(ii) suspending the cellulose material swollen [of] with acetic acid from step (i) in a mixture of sulphuric acid solution [in the] and glacial acetic acid, and

(iii) reacting the cellulose material by adding the acetic anhydride, characterized in that:

- the [chosen] acetic anhydride quantity ranges from 3 to 7 mols/mol of anhydroglucose,
- the esterification time ranges from 1 to 60 mn, and
- the esterification temperature ranges from 25 to 80°C.

Claim 2 has been amended as follows:

2. (amended) Process according to claim 1, characterized in that it comprises a step (iv) during which the reaction of step (iii) [reaction] is stopped by adding an aqueous solution of acetic acid [aqueous solution].

Claim 3 has been amended as follows:

3. (amended) Process according to claim 2, characterized in that it comprises the steps of:

[(v) optionally centrifuging the blend of the above-mentioned step (iv),

(vi) washing and eliminating the optionally obtained residue,

[(vii)] (v) adding water in order to precipitate the optionally generated cellulose triacetates,

[(viii)] (vi) centrifuging, recovering the supernatant and eliminating the residue,

[(ix)] (vii) neutralizing the supernatant [by optional cooling],

[(x)] (viii) dialyzing the resulting precipitate, and

[(xi)] (ix) freeze-drying the solution.

Claim 5 has been amended as follows:

5. (twice amended) Process according to claim 3, characterized in that, at the step [(vii)] (v), the blend is [put] maintained at a temperature of about 4°C for about 16 hours.

Claim 6 has been amended as follows:

6. (twice amended) Process according to claim 3, characterized in that the step [(ix)] (vii), is carried out by a

slow addition of a sodium hydroxide solution until a pH of [aobut] about 7.5 is reached.

Claim 7 has been amended as follows:

7. (twice amended) Process according to claim 3, characterized in that at the step [(ix)] (vii) the blend is cooled in an ice bath and the pH is continuously [followed] monitored so that the pH does not exceed 10.

Claim 8 has been amended as follows:

8. (amended) Process according to claim [8] 7, characterized in that the pH does not exceed 7.5.

Claim 12 has been amended as follows:

12. (twice amended) Process according to claim 1, characterized in that the starting cellulose material is [selected in the group comprising] cellulose residues purified from co-products derived from agriculture [and, more particularly, from cereal bran, for example wheat and corn, but also from wood cellulose, for example pine-tree, or microcrystalline cellulose].

Claim 13 has been amended as follows:

13. (amended) Blend of hydrosoluble cellulose sulfoacetate derivatives [adapted to be] obtained [using] by

performing a process according to [anyone of the preceding claims] claim 1, characterized in that said derivatives have an acetylation degree ranging from 1.5 to 2.4.

Claim 16 has been amended as follows:

16. (twice amended) Derivative blend according to claim 13, characterized in that only the carbon atom which is in position 6 of the anhydroglucose [cycles of said derivatives] is sulphated.